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Hydrous silicic fluid films around solid inclusions in gem-quality diamonds

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Kimberlite-borne diamonds form from fluids or melts circulating at depth in the Earth's mantle. Usually, analysis of this parental material is confined to specific types of diamond, the so-called fibrous or milky varieties. Here we provide the first direct evidence of the common presence of a hydrous silicic fluid surrounding typical peridotitic and eclogitic mineral inclusions in gem-quality diamonds from the Siberian and Kaapvaal cratons. The fluid film (up to 1.5 μm thick) was identified by using confocal micro-Raman spectroscopy and Synchrotron-based X-ray Tomographic Microscopy and contains $Si_2O(OH)_6$, $Si(OH)_4$, and molecular H_2O. This observation would strongly suggest that gem-quality lithospheric diamonds from both major parageneses normally grow in the presence of a water-rich fluid. The presence of the fluid envelope should be taken into account for the interpretation of H_2O contents in solid inclusions and will need to be part of the assessment of diamond formation pressures based on residual pressures of inclusions.

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